The
Liberty Motor
Facts

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Liberty Motor

FACTS

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Owing to the persistent exploitation of certain claims and activities in connection with the LIBERTY MOTOR, wherein facts have been misconstrued and disregarded; because the truth has become so clouded by voluminous articles in newspapers and magazines, also by misinformed and misguided investigators, it may refresh the minds of those who are interested to have again brought to their attention the salient features of this much abused subject.

Inglis M. Uppercu

New York City
February 1, 1919

ADH7882

The Liberty Motor—Facts

The LIBERTY MOTOR was conceived and created by the United States Government. In making this statement it is natural to assume that some Government department had charge of this work, and it will be found that the initiative was taken by Colonel Deeds, then a member of the Aircraft Board.

At the time of our country's entry into the World War, the urgent need was for airplanes in quantities unthought of before, and it was readily seen, after going over data and designs of foreign motors, that the creation of an airplane motor on American methods of production was the logical solution. The Hall-Scott Company, of San Francisco, had been manufacturing and designing successful aeronautic motors since 1908; Colonel Deeds, therefore, called in Mr. Hall, the dominant mind in the creation of the Liberty Motor.

The desirability of having an automotive engineer co-operate in the formulation of recommendations for aircraft motor design was suggested to Mr. Hall by Colonel Deeds, and Mr. Vincent, of the Packard Motor Car Company, then in Washington, was called in conference. A report, dated May 31, 1917, was prepared and submitted to the Aircraft Board at Washington, D. C. This report, signed by J. G. Vincent and E. J. Hall, is as follows:

Washington, D. C., May 31, 1917

Aircraft Production Board
Washington, D. C.

Gentlemen: At your request we have made a careful study of the aircraft motor situation and hasten to submit our report as follows:

In order to get this report in your hands promptly we have condensed it as much as possible and have covered the essentials only.

In view of the fact that there are a number of good motors for training machines available, we have disregarded this type of motor and have confined our attention strictly to the high efficiency low weight per horse-power type such as is necessary at the front.

In order that any motors that are built by this country may be of any value when received at the front, it is, of course, absolutely necessary that their efficiency be brought up to or a little beyond the best now available in Europe. This, of course, made it necessary for us to know just what has been accomplished in Europe. The French and English Commission has enabled us to obtain this information by answering our questions very clearly and completely.

From information obtained from these gentlemen and from other sources, we believe that the Loraine Dietrich is the coming motor in Europe.

This motor has not been built in large quantities as yet, but some thirty had been constructed and carefully tested out at sea level and also at about 6,000 feet elevation. The important facts about this motor are as follows:

Eight cylinders: 120 m/m. bore by 170 m/m. stroke.

Cylinders made of steel with water jackets welded on. Motor is direct driven and develops 250 horse power at 1,500 r.p.m., and 270 horse power at 1,700 r.p.m. The weight of the bare motor is 240 kilos, or approximately 528 pounds, while the weight of the motor complete with radiator and water is 305 kilos, or 671 pounds. There seems to be a reasonable doubt regarding the exact weight of the bare motor, as while the French Commission gave us the figure of 528 pounds, information from other sources indicates a weight of 552 pounds, probably some intermediate figure is more nearly correct, but in any event the motor gives a horse power for approximately two pounds of weight when figured at its maximum output of 270 horse power..

After obtaining this information and considering the matter very carefully, we next investigated the matter of testing such a motor, as we knew that a motor of this type could not be run at full power for long periods of time without developing serious trouble. Here again the French Commission gave us valuable information. They stated that in using a motor of this type it is only run at full power for short periods of time while climbing or fighting, and that all other times it is run at speeds 200 to 300 r.p.m. slower. In view of the fact that the motor is built to run under these conditions, it is, of course, necessary to test it under similar conditions, and they stated when trying out a new model of motor it is their practice to mount a propeller which will just hold the motor down to maximum speed under full throttle. The motor is then run for fifty hours, in periods of six to eight hours each, but the motor is not run up to full speed for more than a total of ten hours during this entire period, nor is it run more than thirty minutes at any single time under this condition. The other forty hours running is under throttled conditions, turning the same propeller 200 to 300 r.p.m. less than maximum speed.

This information is of the utmost importance, as it enables us to reduce all factors of safety and make possible the light weight per horse power now being obtained in Europe.

After obtaining this information we immediately laid down a proposed motor which we believe can be produced promptly in large quantity in this country. Built carefully out of proper materials, this motor will have approximately the following characteristics and be as good, or a little better, than the Loraine Dietrich, which is not as yet really available abroad.

In laying down this motor we have without reserve selected the best possible practice from both Europe and America. Practically all features of this motor have been absolutely proved out in America by experimental work and manufacturing experience in the Hall-Scott and Packard plants, and we are, therefore, willing to unhesitatingly stake our reputations on this design, providing we are allowed to see that our design and specifications are absolutely followed.

The motor is to be of the eight-cylinder type, with cylinders set at an included angle of 45 degrees. The cylinders are of the individual type, made out of steel forgings with jackets welded on. The bore is five inches and the stroke seven inches, giving a piston displacement of 1,100 cubic inches. The crankshaft is of the five-bearing type with all main bearings 2⅜ inches in diameters, and all crank pin bearings 2¼ inches in diameter. The connecting rods are of the I-beam straddle type. This motor is of the direct driven type with a maximum speed of 1,700 r.p.m. This motor will have a maximum output of 275 horse power at 1,700 r.p.m. It will weigh 525 to 550 pounds, but we feel very sure of the lower figure. It will have a gasoline economy of .50 pounds of fuel per horse power hour or better; it will have an oil economy of .04 pounds of oil per horse-power hour, or better. Complete with water and radiator, this motor will not weigh more than 675 pounds if a properly constructed radiator is used and placed high above the motor.

To obtain the above mentioned weights it will be necessary to use the fixed type of propeller hub which has been thoroughly proved out by Hall-Scott practice. In order to obtain the above mentioned weights it will also be necessary, as mentioned above, to use the very best material, workmanship and heat treatment.

Complete detail and assembly drawings, as well as parts list and material specifications, can be completed at the Packard factory under our direction in less than four weeks. We believe that a sample motor can also be completed in approximately six weeks if money is used without stint. As soon as the drawings, specifications and sample motor have been finished, complete information would, of course, be available so that any high grade manufacturer could either make parts for this motor or manufacture it complete.

In laying down this design we have had in mind the extreme importance of interchangeability, as a well laid comprehensive program which has for its base interchangeability of important parts, such as cylinders, will speed output and reduce ultimate cost to an astonishing extent. Europe is suffering right now from lack of uniformity of design, but it is too late for them to change their plan. We, however, can take a leaf out of their book and start right.

In the design which we have laid down, the cylinder, for instance, can be used to make four, six, eight and twelve cylinder motors. As this is the most intricate part to make, immense facilities could be provided to produce them in large quantities for the use of many concerns who could manufacture the balance of the motor. Nearly all small parts and numerous large and important ones would also be interchangeable. This would not only speed up production but would be of the utmost importance in connection with repairs and replacements. A full line of motors made according to this plan would line up about as follows:

Type	Rated Horse-power	Maximum Horse-power	Weight	Weight per Horse-power
4	110	135	375	2.7
6	165	205	490	2.3
8	225	275	535	1.9
12	335	410	710	1.7

Respectfully submitted

(*Signed*) J. G. VINCENT

(*Signed*) E. J. HALL

As these two men, Colonel E. J. Hall of the Hall-Scott Company, and Mr. Vincent of the Packard Motor Car Company, are officially credited with having designed the LIBERTY MOTOR for the United States Government, let us consider the activities of their respective companies before they entered on the design and production of the LIBERTY MOTOR:

> The history of the Hall-Scott Company, one of the pioneer aeronautic engine manufacturers, dates back to 1908; that of the Packard Company's aeronautic endeavors to 1915, and then only in connection with their truck and passenger car business.
>
> The Hall-Scott Company had successfully proved out their motors in actual flying, whereas the Packard Company admit that they had never tried out in a plane any motor they had built
>
> The Hall-Scott Company had commercialized and disposed of large quantities of their motors to foreign governments, as well as the United States Government; the Packard Motor Car Company's only aeronautic motor, offered for production to the United States Government, was rejected as having too little horse-power and too great weight.

As it was desirable to eliminate all experimental and untried features in the LIBERTY MOTOR, it was only natural to assume that both Colonel Hall and Mr. Vincent would use that which had been proved out by their own experience. Therefore, it is interesting to note and compare with the

LIBERTY MOTOR the following designs and dimensions of aeronautic motors built by their respective companies:

(Note: The first LIBERTY MOTOR was of the eight-cylinder type, the manufacture of which was temporarily suspended by the United States Government on account of the urgent demand for greater horse power at that time. However, during the latter part of the summer of 1918, the Government had ordered as large a number of eight-cylinder as twelve-cylinder motors, or even more, and it was generally conceded that the eight-cylinder motor would have been the more universally used if the war had continued. In making the following comparisons the number of cylinders has been disregarded as the fundamentals of construction are the same for any number of cylinders used.)

	Hall-Scott	*Liberty*	*Packard*
Type of Motor........	Direct drive, propeller attached to crankshaft.	Direct drive, propeller attached to crankshaft.	Geared type, propeller attached to jack-shaft. ✓
Crankshaft Design....	Main bearings between each cylinder.	Main bearings between each cylinder.	Main bearings between each pair of cylinders. ✓
Crankshaft Throw.... (Stroke of Motor)	7 inches.	7 inches.	6 inches.
Bore of Cylinders.....	5 inches.	5 inches.	4 inches.
Design of Piston......	Aluminum alloy, special Hall-Scott design.	Aluminum alloy, special Hall-Scott design.	Conventional.
Cylinder Design.......	Separate.	Separate.	In pairs. ✓
Valve Design..........	One exhaust, one inlet.	One exhaust, one inlet.	One exhaust, one inlet.
Camshaft Drive.......	Beveled gear shaft drive.	Beveled gear shaft drive.	Train of spur gears. ✓
Valve Action..........	Overhead camshaft, directly actuated rocker arms.	Overhead camshaft, directly actuated rocker arms.	Overhead camshaft, directly actuated rocker arms.
Oiling System.........	Forced feed and scupper type.	Forced feed and scupper type. ✓	Forced feed throughout.
Propeller Hub........	Hall-Scott special design.	Hall-Scott special design.	Conventional.
Ignition...............	Magneto.	Cadillac improved Delco.	Magneto. — Delco
Connecting Rods......	Forked type	Cadillac forked type.	Forked type
Water Pump..........	Centrifugal.	Centrifugal.	Centrifugal.
Points......	12		3

✓ - Misstatements - Packard like Liberty ✓

It will be noted from the table that the Hall-Scott Company have contributed the greater number of fundamental features incorporated in the LIBERTY MOTOR, and if any one American company must be given the chief credit for having originated the LIBERTY MOTOR, the Hall-Scott Company is unquestionably entitled to this honor and prestige.

Upon Colonel Hall's return from United States service in France, he will be well qualified not only to champion the Hall-Scott Company's activities in this matter, but also to give in detail the most interesting "story" that has ever been told regarding the conception and creation of the LIBERTY MOTOR.

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